

WHAT IS CLAIMED IS:

*Sub
227* 1. ~~An apparatus for gripping and releasing~~ at least one item, comprising:

a pickup head;

at least one gripping plate;

a restraining device corresponding to each gripping plate, the restraining device being configured to connect the corresponding gripping plate to the pickup head so that the gripping plate is movable relative to the pickup head between an open position and a closed position and so that the gripping plate is movable relative to the pickup head in at least one degree of freedom at least when the gripping plate is in the open position and in the closed position; and

an actuation device configured to move the at least one gripping plate between the open position and the closed position.

2. The apparatus according to claim 1, wherein the actuation device includes at least one air cylinder.

3. The apparatus according to claim 1, wherein the actuation device includes at least one air cylinder corresponding to each of the at least one gripping plates.

4. The apparatus according to claim 1, wherein the degree of freedom includes a component in a direction toward and away from the at least one item.

Sub 937 5. The apparatus according to claim 1, further comprising at least one biasing element corresponding to each gripping plate, the at least one biasing element urging the corresponding gripping plate in a direction in accordance with the at least one degree of freedom.

6. The apparatus according to claim 5, wherein the at least one biasing device includes at least one spring element.

Sub 947 7. The apparatus according to claim 1, wherein the restraining device includes a linkage system, the linkage system including a first link having a first end rotatably connected to the pickup head and a second end rotatably connected to the corresponding gripping plate.

8. The apparatus according to claim 7, wherein the second end of the first link is rotatably connected to a first end of the corresponding gripping plate.

NAB → 9. The apparatus according to claim 7, wherein the linkage system includes a second link having a first end connected to the pickup head and a second end having a slot, a portion of the corresponding gripping plate being slidably arranged relative to the slot.

10. The apparatus according to claim 9, wherein the gripping plate includes a pin slidably disposed in the slot.

11. The apparatus according to claim 1, wherein the restraining device includes a camming surface and the gripping plate includes a follower configured to be displaceable in accordance with the camming surface between the open position and the closed position of the corresponding gripping plate.

12. The apparatus according to claim 1, wherein at least one end of the gripping plate is curved.

Sub 457
13. An apparatus for gripping and releasing at least one item, comprising:

a pickup head;

at least one gripping plate;

a restraining device corresponding to each gripping plate, the restraining device being configured to connect the corresponding gripping plate to the pickup head so that the gripping plate is movable relative to the pickup head between an open position and a closed position, an end of the gripping plate being displaced inwardly by the restraining device when the gripping plate moved from the open position to the closed position, the restraining device being further configured to permit the gripping plate to be movable relative to the pickup head in at least one degree of freedom at least when the gripping plate is being moved from the closed position to the open position; and

an actuation device configured to move the at least one gripping plate between the open position and the closed position.

14. The apparatus according to claim 13, further comprising at least one biasing element corresponding to each gripping plate, the at least one biasing element urging the corresponding gripping plate in a direction in accordance with the at least one degree of freedom.

15. The apparatus according to claim 14, wherein the at least one biasing device includes at least one spring element.

16. The apparatus according to claim 13, wherein the actuation device includes at least one air cylinder.

17. The apparatus according to claim 13, wherein the actuation device includes at least one air cylinder corresponding to each of the at least one gripping plates.

18. The apparatus according to claim 13, wherein the degree of freedom includes a component in a direction toward and away from the at least one item.

Sub 247 19. The apparatus according to claim 13, wherein the restraining device includes a linkage system, the linkage system including a first link having a first end rotatably connected to the pickup head and a second end rotatably connected to the corresponding gripping plate.

20. The apparatus according to claim 19, wherein the second end of the first link is rotatably connected to a first end of the corresponding gripping plate.

Sub 977 21. The apparatus according to claim 19, wherein the linkage system includes a second link having a first end connected to the pickup head and a second end having a slot, a portion of the corresponding gripping plate being slidably arranged relative to the slot.

22. The apparatus according to claim 21, wherein the gripping plate includes a pin slidably disposed in the slot.

Sub 287 23. The apparatus according to claim 13, wherein the restraining device includes a camming surface and the gripping plate includes a follower configured to be displaceable in accordance with the camming surface between the open position and the closed position of the corresponding gripping plate.

24. The apparatus according to claim 13, wherein at least one end of the gripping plate is curved.